Annex A-5: Future-Ready Systems

1 Brief Introduction

Annex A-5: Future-Ready Systems analyses the idea of intertwined collaborative nature of human and machine by categorising them across three key systems: Intelligent-Machine, Machine-Machine and Human-Machine. Unlike other annexes which discuss their relevant technologies in isolation, this annex discusses the technology capabilities and developments required for the development of the three systems and points to the decisive actions Singapore must take to become an important player in the global market for Future-Ready Systems.

2 Market Study

Global & Regional Trends

Hyperscale computing power, robotics and AI technologies are three key trends which will impact Future-Ready Systems. Firstly, the global hyperscale computing market is projected to reach USD36.62 Billion by 2020, at a CAGR of 5.45%, with higher computational power driving the hyperscale computing market growth. The Asia Pacific region is expected to witness the highest growth and hyperscale servers to gain maximum market share during the forecast period. Secondly, global robot installations are projected to increase by at least 15% on average per year from 2018 to 2020. By 2021, the Asia Pacific region will be responsible 70% of the world's total spending in the robotics market; spending on robotics (including drones) and related services within the Asia Pacific region was USD66 billion in 2017, over a five-year forecast period of 2017-2021, experts predict the market size to reach a value of USD162 billion by 2021 with a CAGR of 25.2%. Lastly, AI tools are projected to create nearly USD3 trillion in business value by 2021. Within the Asia Pacific region, spending on cognitive and AI systems within the Asia Pacific region is forecasted to reach USD4.6 billion in 2021 with a CAGR of 72.9% over the 2016-2021 forecast period.

Singaporean Trends

An analysis of the Singaporean technology ecosystem reveals its strengths across hyperscale computing, robotics and AI technologies. Singapore has proven to be an attractive hub for companies to set up hyperscale data centres. Furthermore, Singapore is a world leader in robotics as the ABB Automation Readiness Index ranks Singapore 3rd globally as a result of a strong innovation environment, future-oriented education policies and forward-looking labour market policies. In terms of AI, while Singapore has made a number of decisive partnerships and programmes to foster growth of AI solutions locally. These strengths suggest that Singapore has the potential to become a test-bed for advanced technologies within the Asia Pacific region, increasing awareness of advanced technology solutions amongst local businesses. For Singaporean businesses, increased awareness may result in better service provision as they adopt advanced technology solutions spurring them into the advent of Service 4.0. Furthermore, Singapore's expertise in robotics and cognitive technologies confer it unique advantages in the field of augmented robots suggesting that as a nation, Singapore can become a global leader in the development and export of A-bots.

3 Technology Study

Contributions of Future-Ready Systems to Cloud Native Architecture

As a part of the overall technology roadmap recommendation, Singapore needs to establish a cloud native architecture to improve access to emerging technologies amongst the stakeholders and assure Services 4.0. We believe that Future-Ready Systems will play an important part in ensuring the success of the cloud native architecture as highlighted by the exhibit below. *Exhibit 1,* below shows how Future-Ready Systems will contribute to various aspects of cloud native architecture; the exhibit highlights contributions for nine of the technologies, for details, such as technology readiness maps and specific contributions to the cloud architecture platform on 20+ Future-Ready Systems please refer to Annex A-5.

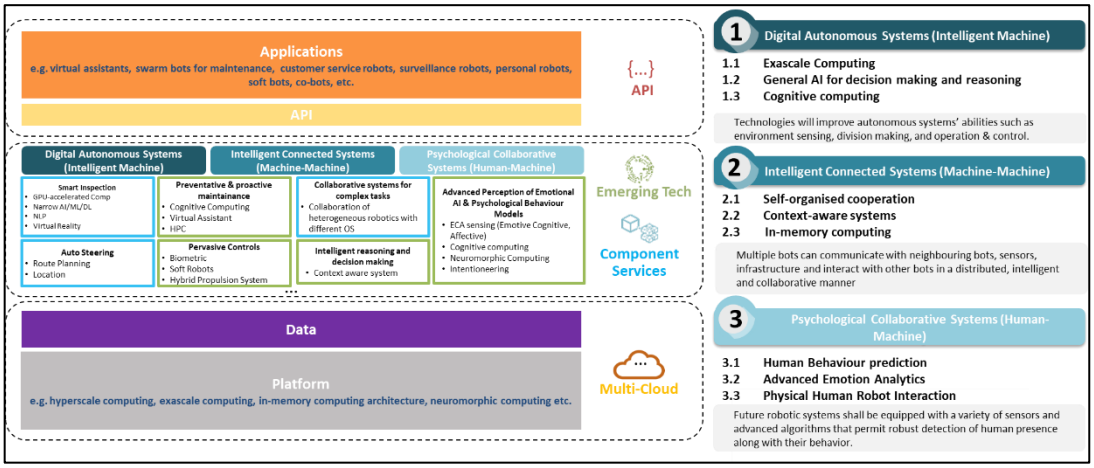

Exhibit 1: Contributions of Future-Ready Systems to Cloud Native Architecture

4 SWOT Analysis

Our study of the Singaporean landscape and the global market for Future-Ready Systems reveals specific strengths, weaknesses, opportunities and threats as discussed in the exhibit below.

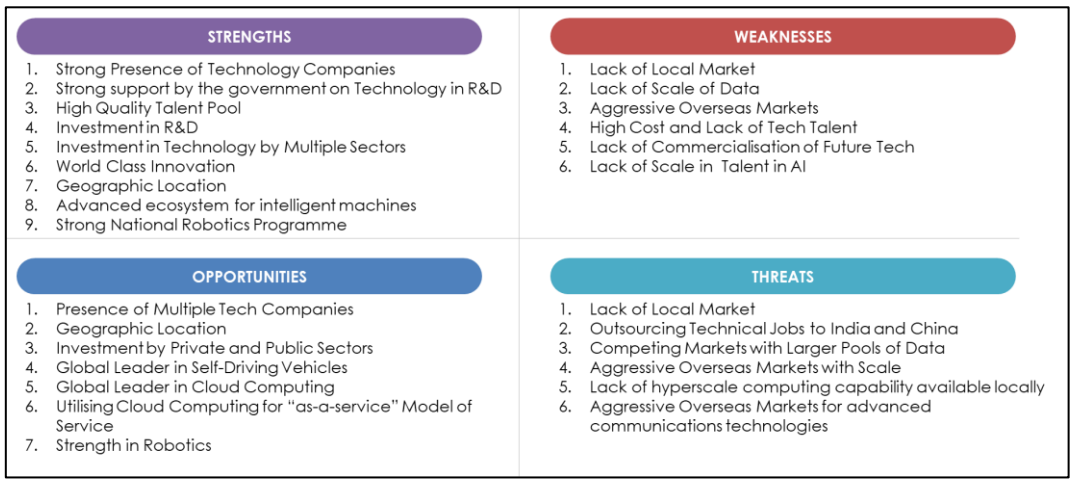

Exhibit 2: SWOT for Future-Ready Technologies

This analysis revealed three guiding principles for recommendations, which leverage Singapore's unique strengths and overcome its weaknesses to build its Future-Ready Systems' capabilities which are:

1. Singapore should aim to become a hub where Future-Ready Systems are developed, piloted and scale up by concerted effort of local and global stakeholders by leveraging Singapore's unique geographic location and highly innovative and 'trusted' environment to attract global investments and talent
2. Singapore should aim to develop technology infrastructure that provides enabling ingredients to develop Future-Ready Systems as well as access to the Future-Ready Systems to maximise adoption; adopting an As-a-Service philosophy in developing and disseminating technology into the ecosystem will greatly help
3. Singapore should continue building its capabilities for the Future-Ready Systems – National Competency Program as while Singapore boasts a strong talent pool, it is constrained in scale; focussing on Future-Ready Systems early on will ensure long term sustainability and competitive advantage

5 Recommendations

1. Singapore should aim to develop research and development (R&D) programme for Future-Ready Systems - Intelligent-Systems-as-a-Service (ISaaS) platforms for R&D of Future-Ready Systems such as Intelligent-Machine, Machine-Machine and Human-Machine systems and its innovative services. This involves employing advanced computing architectures, deployed to meet global demands on various services and APIs including "warm" and "perceptive" human-centric API system technologies, to Intelligent-Machine, Machine-Machine and Human-Machine systems and innovative services e.g. developing 1 exaFLOPS performance capability in Singapore by 2025.
2. Singapore should set up the National Living Lab Framework addressing the value chain of technology readiness levels and together with GLCs, MNCs, SMEs, IHLs, research organisations and start-ups to build a scalable and sustainable SDE in Singapore.
3. Singapore should focus on developing a National Competency Programme which helps develop talent for the development of Future-Ready Systems.
4. Singapore has a number of key differentiating factors which confer it with a unique competitive advantages when developing human-machine systems; one such human-machine system Singapore can focus its R&D efforts on are augmented robots. For further details on A-bots please refer to the recommendations section of Annex A-5.